**Use of Information Systems (IS) to transform the Healthcare Sector in South Africa**

The use of information systems in healthcare (HIS) has been recognised as having crucial importance in improving the efficiency, cost-effectiveness, quality, and safety of medical care delivery. Healthcare Information Systems has the potential to improve individuals’ health and providers’ performance by producing better quality, cost savings, and greater patient involvement in their own health (Gomes & Romao, 2018).

Information system is widely adopted in many fields including healthcare. Healthcare organizations now consider increased efficiency, improved patient care, quality of services, and safety. Hence Health Information System (HIS) is basically introduced to transform the traditional way of data collection and organization in hospitals, to a modern way of systematic collection, maintaining and dissemination of data. Its implementation is to support medical practitioners and administrative staff in securing patients’ health information in a digital-based record, to efficiently and effectively improve performance in the health system or any of its component parts (Mohamadali, & Aziz, 2017).

In South African Context, The South African eHealth Strategy was published in 2012 and acknowledges that health information systems should be used to strengthen the public health care system in the country. While the benefit of electronic health information systems has been documented in the literature, the implementation of these systems in public health care in South Africa remains limited. Currently, patient data is still manually recorded in the patient’s file, while data required for monitoring and evaluation purposes is handwritten by the nurses in registers, aggregated and only the results entered into electronic health information systems for analysis (Wright, Mahony, & Cilliers, 2017).

In South Africa, the eHealth Strategy states that it needs to “implement patient-based information systems at all facilities where healthcare is delivered”, and that all indicator data should be derived from data captured electronically at the point of care (Department of Health, 2012).

There is evidence that health information systems (HIS) can improve the quality of healthcare by increasing adherence to guidelines, enhancing disease surveillance, and decreasing medication errors (Chaundry et al, 2006).

Furthermore, electronic patient record systems (EPRs) can reduce the time spent by nurses on documentation in hospitals (Poissant et al, 2005). The evidence of improved quality and safety of patient care due to EPRs is limited to a few successful sites worldwide, while there is still a lack of evidence of their cost-effectiveness (Black et al, 2011).

The purpose of this literature review is to provide an overview of existing research pertaining to the use of Information Systems (IS) to transform the Healthcare Sector in South Africa, to identify gaps and limitations in the literature, and to further provide suggestions for future research.

Key components of a health information system (HIS) comprises of collecting and recording of data, analysis of data, and communicating the results of the analysis and using it to improve healthcare, for this reason, this literature review will provide secondary research pertaining to the data capture and storage, data analysis and decision-making, communication and collaboration, privacy and security, and interoperability of healthcare information systems to transform the current healthcare sector in South Africa.

The literature that has been used mainly consisted of qualitative, and inductive approach. A literature search for Health Information Systems (HIS) in South Africa was conducted mainly using google scholar and Google search engine.

Presently health information system infrastructure is deficient in resources to meet the demands and needs of increasing population in developing countries. Health care systems of developing countries have major barriers like poverty and lack of technological sophistication. The basic difficulties or barriers in using information technologies include poor or inadequate infrastructure, insufficient access to the hardware and inadequate or poor resources allocation. By eliminating these barriers population health status can be improved in developing countries (Krieg, 1999).

Healthcare information systems refers to such systems that are used to process data, information and knowledge in healthcare environments (Haux et al, 2004).

The eHealth Strategy South Africa 2012-2017 provides a roadmap towards “an integrated and well-functioning national patient-based information system, based on agreed upon scientific standards for interoperability” that improves the efficiency of clinical care, produces the indicators required by management and facilitates patient mobility (Department of Health, 2012). To do this, the national Department of Health (2012) adopted several principles that include “getting the basics right, taking an incremental approach, building on what already exists and looking for early wins”. Among the components identified as new or extended work requiring significant procurement and implementation are:

* Implementation of the foundation of the Electronic Health Record (EHR) and, particularly, a national patient registry and Patient Master Index (PMI).
* Implementation of primary healthcare patient management and Electronic

Medical Record (EMR) system/s at clinics.

* Implementation of Pregnancy and Neonatal EMR system to record clinical details with link to EHR.
* Implementation of EMR system/s to monitor anti-retroviral treatment (ART) and TB treatment.
* Pharmacy systems interface to EMR systems; and
* Implementation of a uniform integrated electronic document and records
* Management system (EDRMS) at all levels (Department of Health, 2012).

The promulgation of the new Health Act and the eHealth Strategy would not singularly transform the country, but they provide the legal and regulatory basis on which other activities are undertaken in the process of change within the health sector.

A number of challenged have been introduced with using information systems to transform the healthcare industry in South Africa, these challenges include ICT Infrastructure, cost and time, national policies toward HIT, social and cultural, educational, organizational, and ethical barriers.

Barriers Related to Infrastructure:

Most of underdeveloped countries do not have required technological infrastructure to establish national health information system (Anwar, & Shamim, 2011) hence cannot promote HIT in private and public hospitals. Reshaping infrastructure of existing health system is very crucial. The following is description of infrastructural barriers:

Poor or Inadequate Infrastructure - Most developing countries do not have adequate required infrastructure such as computer hardware, software, wired and wireless communication channels, Internet, and skilled professional human resource. The availability and operation of these components of ICT Infrastructure are necessary for establishment and promotion of HIT in underdeveloped countries. Strong infrastructure is required for the strong health information system to improve existing health system by planning and introducing new health care interventions which.

results in achieving better health goal (Ehiri, 1999) (Lansang, 2004) (Oak, 2007).

There are poor or inadequate resources allocation for implementation and use of the health technology in the developing countries.

Provision of Computer Hardware and Software - HIT requires specialized software and hardware to improve public health by making evidence-based decisions. Often these software and hardware tools are costly and require sufficient training for proper operation.

Poor Internet Availability - Poor internet availability is a vital infrastructure barrier. Health care specialists have poor access to real time information and the available information is not according to the local situation. This available information cannot be used for evidence-based decisions. Without having a proper local area network and internet facility inter-organizational and intraorganizational communication is not possible. This is a backbone for any information system (Oak, 2007).

Lack of professional human resource workforce and lack of trainings to produce this workforce - A computerized information system requires skilled personnel for its effective operation. Training is one of the aspects for use of any new technology. Deficiency of skilled workforce can be overcome by providing appropriate training in the required area. A proper training module in constructing architecture of a reliable database should be available. If it is not implemented, then outcomes or results gained by such type of databases gives unauthentic results which can neither be used for decision making process nor for evidence-based practice. Training requires cost as well as time.

Cost and Time Barriers:

Major problem in organizing workshops and trainings for establishment and implementation of HIT in underdeveloped countries is financial and time constraint (Oak, 2007) (Sluijs et al, 2006), (Paul, 2004) (Paul et al, 1998).

Transformation of any system is a difficult task and cannot complete in short time period. Barriers like lack of skilled workforce, infrastructure, and cost along with other effects like initial decrease of productivity due to adjustment with new technological environment and system itself impose, strong limits to the introduction and adaption of new health technologies (Oak, 2007) (Paul et al, 1998). It requires years and years for transformation process to complete.

National Policies towards HIT:

Efficient, effective, and secure national policy can address the local health needs according to the changing environment is needed. These policies can be devised by policy makers and practitioners to assess and implement research evidence (Oak, 2007), (Sluijs et al, 2006). Enforcing the legislation is difficult in developing countries and acceptance by the community for the transformation of any system is harder (Oak, 2007) (Tessa, & Eider, 2000). Total amount of Rs. 663 billion has been allocated in PSDP (Public Sector Development Program) 2010-11 for various ongoing and new schemes Out of this only Rs.16944.5 million gas been allocated for development of Health Division with 2.1% population average annual growth which is abysmally low (Martinez, 2005).

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Social and Cultural Barriers:

Digital divide and e-readiness are major social and cultural barriers in establishment and use of health information system. These barriers include lack of stakeholder’s interest, less motivation, anxiety to adapt and use new technology. Health care personnel are difficult to convince for use of new health technologies. As they are more comfortable with their conventional approach and routine practice, so it is complicated to transform health information system from paper based to digital format (Oak, 2007) (Tessa, & Eider, 2000).

Educational Barriers:

Professional education in health informatics is badly ignored and missing in curriculum of medical institutes for undergraduates. Although module of education related to IT use in research is included in postgraduate curriculum, but it is the need of the hour to include this area in medical professional education at graduate level. Transformation of our existing paper-based health system into computerized information system is not possible without providing the basic IT knowledge to health professionals.

Organizational Barriers:

Organizations and people play a very critical role in implementing and transformation of an information system. First, there are no documented studies available regarding level and use, benefits, cost, risk analysis and other aspects of health technology in health sector of underdeveloped countries and if they are available for the developing countries they are not well communicated. Secondly, people at higher positions and posts, whose needs of reporting are adequately being catered by the existing system, do not favour HIT as they think that the employment of new technology is wastage of both the money and time. Hospitals must address the apprehension of physicians because if by using HIT their professional responsibilities become difficult, they will never support its use (Reider, 2003).

In Conclusion, the literature analysed and reviewed does not have contrasting and/or contradicting views, very similar aspects pertaining to the state of the information systems in South Africa, how best to use the information systems in aiding the transformation of the healthcare sector, and the challenges faced in South Africa pertaining to the transformation of the healthcare sector using information systems are similar and the broad consensus of the literature share the same views and sentiments.

The use of information systems in healthcare has the potential to transform the healthcare sector in South Africa. However, there are several challenges that need to be addressed to ensure successful implementation, including a lack of infrastructure and resources, resistance to change, and security and privacy concerns. To address these challenges, improvements can be made through investment in infrastructure and resources, education and training, security and privacy measures, and policy and regulatory frameworks. Further expansion of this research can be suggested that aims at the challenges faced by South Africa, and ways to addressing them, e.g., improving the technological infrastructure to take advantage of information systems to transform the healthcare sector. By addressing these challenges and implementing improvements, the healthcare sector in South Africa can benefit from the transformational power of information systems.

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